

## WE CLAIM:

1. A method for treating alopecia or promoting hair growth in an animal, which comprises administering to said animal an effective amount of a  
5 pipecolic acid derivative.

2. The method of claim 1, wherein the pipecolic acid derivative has an affinity for an FKBP-type  
10 immunophilin.

3. The method of claim 2, wherein the FKBP-type immunophilin is FKBP-12.

4. The method of claim 1, wherein the pipecolic acid derivative is immunosuppressive.  
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5. The method of claim 1, wherein the pipecolic acid derivative is non-immunosuppressive.  
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6. The method of claim 1, wherein the pipecolic acid derivative is Way-124,666.

7. The method of claim 1, wherein the pipecolic acid derivative is rapamycin.  
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8. The method of claim 1, wherein the pipecolic acid derivative is Rap-Pa.

9. The method of claim 1, wherein the pipecolic acid derivative is SLB-506.

10. The method of claim 1, wherein the pipecolic acid derivative is selected from the group consisting of:

4-(4-methoxyphenyl)butyl (2*S*)-1-[2-(3,4,5-trimethoxyphenyl)acetyl]hexahydro-2-pyridinecarboxylate;

10 4-(4-methoxyphenyl)butyl (2*S*)-1-[2-(3,4,5-trimethoxyphenyl)acryloyl]hexahydro-2-pyridinecarboxylate;

4-(4-methoxyphenyl)butyl (2*S*)-1-[2-(3,4,5-trimethoxyphenyl)propanoyl]hexahydro-2-pyridinecarboxylate;

15 4-(4-methoxyphenyl)butyl (2*S*)-1-[2-oxo-2-(3,4,5-trimethoxyphenyl)acetyl]hexahydro-2-pyridinecarboxylate;

3-cyclohexylpropyl (2*S*)-1-(3,3-dimethyl-2-oxopentanoyl)hexahydro-2-pyridinecarboxylate;

3-phenylpropyl (2*S*)-1-(3,3-dimethyl-2-oxopentanoyl)hexahydro-2-pyridinecarboxylate;

3-(3,4,5-trimethoxyphenyl)propyl (2*S*)-1-(3,3-dimethyl-2-oxopentanoyl)hexahydro-2-pyridinecarboxylate;

25 (1*R*)-2,2-dimethyl-1-phenethyl-3-butenyl (2*S*)-1-(3,3-dimethyl-2-oxopentanoyl)hexahydro-2-pyridinecarboxylate;

(1R)-1,3-diphenylpropyl (2S)-1-(3,3-dimethyl-2-oxopentanoyl)hexahydro-2-pyridinecarboxylate;

(1R)-1-cyclohexyl-3-phenylpropyl (2S)-1-(3,3-dimethyl-2-oxopentanoyl)hexahydro-2-pyridinecarboxylate;

(1S)-1,3-diphenylpropyl (2S)-1-(3,3-dimethyl-2-oxopentanoyl)hexahydro-2-pyridinecarboxylate;

(1S)-1-cyclohexyl-3-phenylpropyl (2S)-1-(3,3-dimethyl-2-oxopentanoyl)hexahydro-2-pyridinecarboxylate;

(22aS)-15,15-dimethylperhydropyrido[2,1-c][1,9,4]dioxazacyclononadecine-1,12,16,17-tetraone;

(24aS)-17,17-dimethylperhydropyrido[2,1-c][1,9,4]dioxazacyclohenicosine-1,14,18,19-tetraone;

ethyl 1-(2-oxo-3-phenylpropanoyl)-2-piperidinecarboxylate;

ethyl 1-pyruvoyl-2-piperidinecarboxylate;

ethyl 1-(2-oxobutanoyl)-2-piperidinecarboxylate;

ethyl 1-(3-methyl-2-oxobutanoyl)-2-piperidinecarboxylate;

ethyl 1-(4-methyl-2-oxopentanoyl)-2-piperidinecarboxylate;

ethyl 1-(3,3-dimethyl-2-oxobutanoyl)-2-piperidinecarboxylate;

ethyl 1-(3,3-dimethyl-2-oxopentanoyl)-2-piperidinecarboxylate;

4-[2-(ethyloxycarbonyl)piperidino]-2,2-dimethyl-3,4-dioxobutyl acetate;

ethyl 1-[2-(2-hydroxytetrahydro-2H-2-pyranyl)-2-oxoacetyl]-2-piperidinecarboxylate;

ethyl 1-[2-(2-methoxytetrahydro-2H-2-pyranyl)-2-oxoacetyl]-2-piperidinecarboxylate;

5 ethyl 1-[2-(1-hydroxycyclohexyl)-2-oxoacetyl]-2-piperidinecarboxylate;

ethyl 1-[2-(1-methoxycyclohexyl)-2-oxoacetyl]-2-piperidinecarboxylate;

10 ethyl 1-(2-cyclohexyl-2-oxoacetyl)-2-piperidinecarboxylate;

ethyl 1-(2-oxo-2-piperidinoacetyl)-2-piperidinecarboxylate;

ethyl 1-[2-(3,4-dihydro-2H-6-pyranyl)-2-oxoacetyl]-2-piperidinecarboxylate;

15 ethyl 1-(2-oxo-2-phenylacetyl)-2-piperidinecarboxylate;

ethyl 1-(4-methyl-2-oxo-1-thioxopentyl)-2-piperidinecarboxylate;

20 3-phenylpropyl 1-(2-hydroxy-3,3-dimethylpentanoyl)-2-piperidinecarboxylate;

(1R)-1-phenyl-3-(3,4,5-trimethoxyphenyl)propyl 1-(3,3-dimethylbutanoyl)-2-piperidinecarboxylate;

(1R)-1,3-diphenylpropyl 1-(benzylsulfonyl)-2-piperidinecarboxylate;

25 3-(3,4,5-trimethoxyphenyl)propyl 1-(benzylsulfonyl)-2-piperidinecarboxylate;

1-(2-[(2R,3R,6S)-6-[(2S,3E,5E,7E,9S,11R)-2,13-dimethoxy-3,9,11-trimethyl-12-oxo-3,5,7-

tridecatrienyl]-2-hydroxy-3-methyltetrahydro-2H-2-pyran-2-yl)-2-oxoacetyl)-2-piperidinecarboxylic acid;

5 methyl 1-(2-[(2R,3R,6S)-6-[(2S,3E,5E,7E,9S,11R)-2,13-dimethoxy-3,9,11-trimethyl-12-oxo-3,5,7-tridecatrienyl]-2-hydroxy-3-methyltetrahydro-2H-2-pyran-2-yl)-2-oxoacetyl)-2-piperidinecarboxylate;

10 isopropyl 1-(2-[(2R,3R,6S)-6-[(2S,3E,5E,7E,9S,11R)-2,13-dimethoxy-3,9,11-trimethyl-12-oxo-3,5,7-tridecatrienyl]-2-hydroxy-3-methyltetrahydro-2H-2-pyran-2-yl)-2-oxoacetyl)-2-piperidinecarboxylate;

15 benzyl 1-(2-[(2R,3R,6S)-6-[(2S,3E,5E,7E,9S,11R)-2,13-dimethoxy-3,9,11-trimethyl-12-oxo-3,5,7-tridecatrienyl]-2-hydroxy-3-methyltetrahydro-2H-2-pyran-2-yl)-2-oxoacetyl)-2-piperidinecarboxylate;

20 1-phenylethyl 1-(2-[(2R,3R,6S)-6-[(2S,3E,5E,7E,9S,11R)-2,13-dimethoxy-3,9,11-trimethyl-12-oxo-3,5,7-tridecatrienyl]-2-hydroxy-3-methyltetrahydro-2H-2-pyran-2-yl)-2-oxoacetyl)-2-piperidinecarboxylate;

25 (Z)-3-phenyl-2-propenyl 1-(2-[(2R,3R,6S)-6-[(2S,3E,5E,7E,9S,11R)-2,13-dimethoxy-3,9,11-trimethyl-12-oxo-3,5,7-tridecatrienyl]-2-hydroxy-3-methyltetrahydro-2H-2-pyran-2-yl)-2-oxoacetyl)-2-piperidinecarboxylate;

3-(3,4-dimethoxyphenyl)propyl 1-(2-[(2R,3R,6S)-6-[(2S,3E,5E,7E,9S,11R)-2,13-dimethoxy-3,9,11-trimethyl-12-oxo-3,5,7-tridecatrienyl]-2-hydroxy-3-

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3-phenylpropyl 1-(2-oxo-2-phenylacetyl)-2-piperidinecarboxylate;

3-(3-pyridyl)propyl 1-(2-oxo-2-phenylacetyl)-2-

piperidinecarboxylate;

3-(3-pyridyl)propyl 1-(3,3-dimethyl-2-oxopentanoyl)-2-piperidinecarboxylate;

4-phenyl-1-(3-phenylpropyl)butyl 1-(3,3-dimethyl-2-oxopentanoyl)-2-piperidinecarboxylate;

4-(4-methoxyphenyl)butyl 1-(3,3-dimethyl-2-oxopentanoyl)-2-piperidinecarboxylate;

1-(4-methoxyphenethyl)-4-phenylbutyl 1-(3,3-dimethyl-2-oxopentanoyl)-2-piperidinecarboxylate;

3-(2,5-dimethoxyphenyl)propyl 1-(3,3-dimethyl-2-oxopentanoyl)-2-piperidinecarboxylate;

3-(1,3-benzodioxol-5-yl)propyl 1-(3,3-dimethyl-2-oxopentanoyl)-2-piperidinecarboxylate;

1-phenethyl-3-phenylpropyl 1-(3,3-dimethyl-2-oxopentanoyl)-2-piperidinecarboxylate;

4-(4-methoxyphenyl)butyl 1-(2-cyclohexyl-2-oxoacetyl)-2-piperidinecarboxylate;

3-cyclohexylpropyl 1-(2-cyclohexyl-2-oxoacetyl)-2-piperidinecarboxylate;

3-phenylpropyl 1-(2-cyclohexyl-2-oxoacetyl)-2-piperidinecarboxylate;

3-cyclohexylpropyl 1-(3,3-dimethyl-2-oxobutanoyl)-2-piperidinecarboxylate;

3-phenylpropyl 1-(3,3-dimethyl-2-oxobutanoyl)-2-piperidinecarboxylate;

4-(4-methoxyphenyl)butyl 1-(3,3-dimethyl-2-oxobutanoyl)-2-piperidinecarboxylate;

4-phenyl-1-(3-phenylpropyl)butyl 1-(3,3-dimethyl-

2-oxobutanoyl)-2-piperidinecarboxylate; and  
pharmaceutically acceptable salts, esters, and  
solvates thereof.

5           11. A pharmaceutical composition which  
comprises:

- (i) an effective amount of a pipecolic acid  
derivative for treating alopecia or  
promoting hair growth in an animal; and  
10           (ii) a pharmaceutically acceptable carrier.

12. The pharmaceutical composition of claim 11,  
wherein the pipecolic acid derivative has an affinity  
for an FKBP-type immunophilin.

15           13. The pharmaceutical composition of claim 12,  
wherein the FKBP-type immunophilin is FKBP-12.

14. The pharmaceutical composition of claim 11,  
20           wherein the pipecolic acid derivative is  
immunosuppressive.

15. The pharmaceutical composition of claim 11,  
wherein the pipecolic acid derivative is non-  
25           immunosuppressive.

16. The pharmaceutical composition of claim 11,  
wherein the pipecolic acid derivative is Way-124,666.



17. The pharmaceutical composition of claim 11,  
wherein the pipecolic acid derivative is rapamycin.

18. The pharmaceutical composition of claim 11,  
5 wherein the pipecolic acid derivative is Rap-Pa.

19. The pharmaceutical composition of claim 11,  
wherein the pipecolic acid derivative is SLB-506.

10 20. The pharmaceutical composition of claim 11,  
wherein the pipecolic acid derivative is selected from  
the group consisting of:

4-(4-methoxyphenyl)butyl (2S)-1-[2-(3,4,5-  
trimethoxyphenyl)acetyl]hexahydro-2-  
15 pyridinecarboxylate;

4-(4-methoxyphenyl)butyl (2S)-1-[2-(3,4,5-  
trimethoxyphenyl)acryloyl]hexahydro-2-  
pyridinecarboxylate;

4-(4-methoxyphenyl)butyl (2S)-1-[2-(3,4,5-  
20 trimethoxyphenyl)propanoyl]hexahydro-2-  
pyridinecarboxylate;

4-(4-methoxyphenyl)butyl (2S)-1-[2-oxo-2-(3,4,5-  
trimethoxyphenyl)acetyl]hexahydro-2-  
pyridinecarboxylate;

25 3-cyclohexylpropyl (2S)-1-(3,3-dimethyl-2-  
oxopentanoyl)hexahydro-2-pyridinecarboxylate;

3-phenylpropyl (2S)-1-(3,3-dimethyl-2-  
oxopentanoyl)hexahydro-2-pyridinecarboxylate;

3-(3,4,5-trimethoxyphenyl)propyl (2S)-1-(3,3-dimethyl-2-oxopentanoyl)hexahydro-2-pyridinecarboxylate;

(1R)-2,2-dimethyl-1-phenethyl-3-butenyl (2S)-1-(3,3-dimethyl-2-oxopentanoyl)hexahydro-2-pyridinecarboxylate;

(1R)-1,3-diphenylpropyl (2S)-1-(3,3-dimethyl-2-oxopentanoyl)hexahydro-2-pyridinecarboxylate;

(1R)-1-cyclohexyl-3-phenylpropyl (2S)-1-(3,3-dimethyl-2-oxopentanoyl)hexahydro-2-pyridinecarboxylate;

(1S)-1,3-diphenylpropyl (2S)-1-(3,3-dimethyl-2-oxopentanoyl)hexahydro-2-pyridinecarboxylate;

(1S)-1-cyclohexyl-3-phenylpropyl (2S)-1-(3,3-dimethyl-2-oxopentanoyl)hexahydro-2-pyridinecarboxylate;

(22aS)-15,15-dimethylperhydropyrido[2,1-c][1,9,4]dioxazacyclononadecine-1,12,16,17-tetraone;

(24aS)-17,17-dimethylperhydropyrido[2,1-c][1,9,4]dioxazacyclohenicosine-1,14,18,19-tetraone;

ethyl 1-(2-oxo-3-phenylpropanoyl)-2-piperidinecarboxylate;

ethyl 1-pyruvoyl-2-piperidinecarboxylate;

ethyl 1-(2-oxobutanoyl)-2-piperidinecarboxylate;

ethyl 1-(3-methyl-2-oxobutanoyl)-2-piperidinecarboxylate;

ethyl 1-(4-methyl-2-oxopentanoyl)-2-piperidinecarboxylate;

ethyl 1-(3,3-dimethyl-2-oxobutanoyl)-2-piperidinecarboxylate;

ethyl 1-(3,3-dimethyl-2-oxopentanoyl)-2-piperidinecarboxylate;

5 4-[2-(ethyloxycarbonyl)piperidino]-2,2-dimethyl-3,4-dioxobutyl acetate;

ethyl 1-[2-(2-hydroxytetrahydro-2H-2-pyranyl)-2-oxoacetyl]-2-piperidinecarboxylate;

10 ethyl 1-[2-(2-methoxytetrahydro-2H-2-pyranyl)-2-oxoacetyl]-2-piperidinecarboxylate;

ethyl 1-[2-(1-hydroxycyclohexyl)-2-oxoacetyl]-2-piperidinecarboxylate;

ethyl 1-[2-(1-methoxycyclohexyl)-2-oxoacetyl]-2-piperidinecarboxylate;

15 ethyl 1-(2-cyclohexyl-2-oxoacetyl)-2-piperidinecarboxylate;

ethyl 1-(2-oxo-2-piperidinoacetyl)-2-piperidinecarboxylate;

20 ethyl 1-[2-(3,4-dihydro-2H-6-pyranyl)-2-oxoacetyl]-2-piperidinecarboxylate;

ethyl 1-(2-oxo-2-phenylacetyl)-2-piperidinecarboxylate;

ethyl 1-(4-methyl-2-oxo-1-thioxopentyl)-2-piperidinecarboxylate;

25 3-phenylpropyl 1-(2-hydroxy-3,3-dimethylpentanoyl)-2-piperidinecarboxylate;

(1R)-1-phenyl-3-(3,4,5-trimethoxyphenyl)propyl 1-(3,3-dimethylbutanoyl)-2-piperidinecarboxylate;

(1*R*)-1,3-diphenylpropyl 1-(benzylsulfonyl)-2-piperidinecarboxylate;

3-(3,4,5-trimethoxyphenyl)propyl 1-(benzylsulfonyl)-2-piperidinecarboxylate;

5 1-(2-[(2*R*,3*R*,6*S*)-6-[(2*S*,3*E*,5*E*,7*E*,9*S*,11*R*)-2,13-dimethoxy-3,9,11-trimethyl-12-oxo-3,5,7-tridecatrienyl]-2-hydroxy-3-methyltetrahydro-2*H*-2-pyranyl)-2-oxoacetyl)-2-piperidinecarboxylic acid;

10 methyl 1-(2-[(2*R*,3*R*,6*S*)-6-[(2*S*,3*E*,5*E*,7*E*,9*S*,11*R*)-2,13-dimethoxy-3,9,11-trimethyl-12-oxo-3,5,7-tridecatrienyl]-2-hydroxy-3-methyltetrahydro-2*H*-2-pyranyl)-2-oxoacetyl)-2-piperidinecarboxylate;

15 isopropyl 1-(2-[(2*R*,3*R*,6*S*)-6-[(2*S*,3*E*,5*E*,7*E*,9*S*,11*R*)-2,13-dimethoxy-3,9,11-trimethyl-12-oxo-3,5,7-tridecatrienyl]-2-hydroxy-3-methyltetrahydro-2*H*-2-pyranyl)-2-oxoacetyl)-2-piperidinecarboxylate;

20 benzyl 1-(2-[(2*R*,3*R*,6*S*)-6-[(2*S*,3*E*,5*E*,7*E*,9*S*,11*R*)-2,13-dimethoxy-3,9,11-trimethyl-12-oxo-3,5,7-tridecatrienyl]-2-hydroxy-3-methyltetrahydro-2*H*-2-pyranyl)-2-oxoacetyl)-2-piperidinecarboxylate;

25 1-phenylethyl 1-(2-[(2*R*,3*R*,6*S*)-6-[(2*S*,3*E*,5*E*,7*E*,9*S*,11*R*)-2,13-dimethoxy-3,9,11-trimethyl-12-oxo-3,5,7-tridecatrienyl]-2-hydroxy-3-methyltetrahydro-2*H*-2-pyranyl)-2-oxoacetyl)-2-piperidinecarboxylate;

(*Z*)-3-phenyl-2-propenyl 1-(2-[(2*R*,3*R*,6*S*)-6-[(2*S*,3*E*,5*E*,7*E*,9*S*,11*R*)-2,13-dimethoxy-3,9,11-trimethyl-

12-oxo-3,5,7-tridecatrienyl]-2-hydroxy-3-methyltetrahydro-2H-2-pyranyl)-2-oxoacetyl)-2-piperidinecarboxylate;

3-(3,4-dimethoxyphenyl)propyl 1-(2-[(2R,3R,6S)-6-  
5 [(2S,3E,5E,7E,9S,11R)-2,13-dimethoxy-3,9,11-trimethyl-12-oxo-3,5,7-tridecatrienyl]-2-hydroxy-3-methyltetrahydro-2H-2-pyranyl)-2-oxoacetyl)-2-piperidinecarboxylate;

N2-benzyl-1-(2-[(2R,3R,6S)-6-  
10 [(2S,3E,5E,7E,9S,11R)-2,13-dimethoxy-3,9,11-trimethyl-12-oxo-3,5,7-tridecatrienyl]-2-hydroxy-3-methyltetrahydro-2H-2-pyranyl)-2-oxoacetyl)-2-piperidinecarboxylate;

N2-(3-phenylpropyl)-1-(2-[(2R,3R,6S)-6-  
15 [(2S,3E,5E,7E,9S,11R)-2,13-dimethoxy-3,9,11-trimethyl-12-oxo-3,5,7-tridecatrienyl]-2-hydroxy-3-methyltetrahydro-2H-2-pyranyl)-2-oxoacetyl)-2-piperidinecarboxylate;

(E)-3-(3,4-dichlorophenyl)-2-propenyl 1-(3,3-dimethyl-2-oxopentanoyl)-2-piperidinecarboxylate;

(E)-3-(3,4,5-trimethoxyphenyl)-2-propenyl 1-(3,3-dimethyl-2-oxopentanoyl)-2-piperidinecarboxylate;

(E)-3-phenyl-2-propenyl 1-(3,3-dimethyl-2-oxopentanoyl)-2-piperidinecarboxylate;

25 (E)-3-((3-(2,5-dimethoxy)-phenylpropyl)phenyl)-2-propenyl 1-(3,3-dimethyl-2-oxopentanoyl)-2-piperidinecarboxylate;

(E)-3-(1,3-benzodioxol-5-yl)-2-propenyl 1-(3,3-

- dimethyl-2-oxopentanoyl)-2-piperidinecarboxylate;
- 4-(4-methoxyphenyl)butyl 1-(2-oxo-2-phenylacetyl)-2-piperidinecarboxylate;
- 3-phenylpropyl 1-(2-oxo-2-phenylacetyl)-2-piperidinecarboxylate;
- 5 3-(3-pyridyl)propyl 1-(2-oxo-2-phenylacetyl)-2-piperidinecarboxylate;
- 3-(3-pyridyl)propyl 1-(3,3-dimethyl-2-oxopentanoyl)-2-piperidinecarboxylate;
- 10 4-phenyl-1-(3-phenylpropyl)butyl 1-(3,3-dimethyl-2-oxopentanoyl)-2-piperidinecarboxylate;
- 4-(4-methoxyphenyl)butyl 1-(3,3-dimethyl-2-oxopentanoyl)-2-piperidinecarboxylate;
- 1- (4-methoxyphenethyl)-4-phenylbutyl 1-(3,3-dimethyl-2-oxopentanoyl)-2-piperidinecarboxylate;
- 15 3-(2,5-dimethoxyphenyl)propyl 1-(3,3-dimethyl-2-oxopentanoyl)-2-piperidinecarboxylate;
- 3-(1,3-benzodioxol-5-yl)propyl 1-(3,3-dimethyl-2-oxopentanoyl)-2-piperidinecarboxylate;
- 20 1-phenethyl-3-phenylpropyl 1-(3,3-dimethyl-2-oxopentanoyl)-2-piperidinecarboxylate;
- 4-(4-methoxyphenyl)butyl 1-(2-cyclohexyl-2-oxoacetyl)-2-piperidinecarboxylate;
- 3-cyclohexylpropyl 1-(2-cyclohexyl-2-oxoacetyl)-2-piperidinecarboxylate;
- 25 3-phenylpropyl 1-(2-cyclohexyl-2-oxoacetyl)-2-piperidinecarboxylate;
- 3-cyclohexylpropyl 1-(3,3-dimethyl-2-

oxobutanoyl)-2-piperidinecarboxylate;

3-phenylpropyl 1-(3,3-dimethyl-2-oxobutanoyl)-2-piperidinecarboxylate;

4-(4-methoxyphenyl)butyl 1-(3,3-dimethyl-2-oxobutanoyl)-2-piperidinecarboxylate;

4-phenyl-1-(3-phenylpropyl)butyl 1-(3,3-dimethyl-2-oxobutanoyl)-2-piperidinecarboxylate; and

pharmaceutically acceptable salts, esters, and solvates thereof.

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